THE USES OF INSECT GALLS

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INTRODUCTION

THIS paper, which is a contribution from the Branch of Forest Insects, Bureau of Entomology, is a summary of an extensive study of the literature dealing with the uses of insect galls. It was made primarily to obtain a history of the use of the Aleppo gall in the dyeing industry. In the preparation of this paper I have been assisted by Mr. S. A. Rohwer under whose direction the research of the literature was made.

For centuries before the real origin of insect galls was known, they were noted and given a place, like most other vegetable substances, among remedies for diseases. The ignorance of their origin gave rise to queer superstitions and practises even among scholars, especially in the Middle Ages, when they were gravely recorded as supernatural growths and employed as a means of foretelling the events of the coming year. The gall was supposed to contain a maggot, a fly, or a spider, each of which betokened some misfortune. If the inhabitant were a maggot the coming year would bring famine, if a fly, war, or if a spider, pestilence. This belief was recorded and practised for several centuries, even after the time of Malpighi, who was the first in the Western World to discover and make known the true origin of insect galls.

The record of the practical use of galls has come down from the old physicians and naturalists of Greece and Rome. Their observations were confined chiefly to the Aleppo gall and the Bedeguar of the rose, but an interesting statement is found concerning two galls which were used by the Greeks to burn without oil in their lamps.

These were *Cynips theophrastea* and an undetermined gall called by Pliny the black gall-nut.

Until very recently in all histories of drugs, tanning, and dyeing, galls have been considered as of great importance, and at the present time are among the most valued ingredients of ink. The first use of galls was in medicine and many besides those discussed below have been listed as drugs.

Among the Cynipids is the gall of field cirsium produced by *Cynips* species (determined by Cuvier) which was formerly considered, if merely carried in the pocket, as a very efficacious remedy for hemorrhages. Others merely mentioned are (*Cynips quercus-terminalis*) = *Biorhiza pallida, Cynips polycera, Cynips quercus-tozæ, Dryophanta quercus-folii, Andricus fœcundatrix,* and the undetermined galls called by Guibort, *galle corniculée, galle marmorine,* and *galle d'Istrie.* This last, according to Trimble, yields 24 per cent. tannic acid.

Besides the Cynipid galls there is a gall on *Pistachia khinjuk,* called Gúl-i-pista, produced by *Pemphigus pallidus,* which enters into the materia medica of India. Two other Indian galls used in medicine are found on *Tamarix.* One, called Bara-Mai, occurs on *Tamarix gallica,* and the other, Chota-Mai, occurs on *Tamarix orientalis.* Another *Tamarix* gall said to have been used by the Egyptians in medicine is one called by them Chersamel, and by the Turks, according to Fockeu, Bazgendge.

To the Cynipids useful in tanning Kieffer has added *Cynips lignicola* and *Cynips hungarica;* and to those used in dyeing, (*Cynips tinctoria-nostra*) = *Cynips infectoria* Hartig. *Cynips quercus-petioli* Linnæus, according to the *Gardeners' Chronicle,* 1854, is also capable of forming a strong black dye.

Burton in his journeys in East Africa noted a gall-nut which was used by the Somali women as the basis of their tattooing dye. This gall has not been determined, but the record is of interest as being the only one encountered of a savage people's making use of galls.

Another undetermined gall is that called by Pomet "Bazdyendge" and described by him as a reddish gall on a species of oak in Turkey, which was used with cochineal and tartar to make a very fine scarlet.

So far as can be ascertained no American galls were ever used for any practical purpose by the Indian (statement of Dr. Hough, U. S. National Museum), and but few by the white man. No interest appears to have been taken in this phase of gall history in America until Trimble, through his interest in the history of tannins, took up the question of tannic acid in galls and analyzed a few North American galls. He found that many of these galls contained relatively large amounts of tannin. He stated that there are more oaks in the United States than in Europe which are available for tanning, and that as the gall partakes of the character of its host-plant then there must necessarily be more oak galls in this country suitable for tanning. He also remarks that it is not known that all species of oak yield the same tannin, therefore we may look for a variation in the properties and composition of the tannins from different species.

Of the Cynipid galls examined by Trimble the richest in tannin is one from Texas, on *Quercus virens,* closely resembling the Aleppo gall and containing 40 per cent. tannic acid. This has been identified by Mr. S. A. Rohwer as *Disholcaspis cinerosa. Acraspis erinacei* (determined by L. O. Howard) was found to contain 17.89 per cent. tannic acid and *Disholcaspis globulus* Fitch, 3.91 per cent.

A Dipterous gall on *Quercus alba,* determined by L. O. Howard as *Cecidomyia* or *Diplosis* species, contains, according to Trimble, 9.24 per cent. tannic when air-dried, and 31.68 per cent. when quickly dried by artificial heat at 80 degrees.

A gall occurring on *Rhus glabra,* in many ways the counterpart of the Chinese gall, was found by Trimble to yield, when air-dried, 61.70 per cent. tannic acid which is about 8.3 per cent. less than the Chinese galls yield and about 3 per cent. less than the Aleppo. This has been

identified by Mr. A. C. Baker as *Melaphis rhois* Fitch.

Besides the American galls suggested by Trimble as being of possible use in the industries, a few have been recorded as food.

The galls of *Disholcaspis weldi* (Beutenmüller) which occur on *Quercus reticulata* in Mexico were purchased at a fruit stand in Mexico City.

Oak-apple galls produced by *Cynips* spp. are eaten by school children, and some of them are said to be sweeter than sugar.

The most important record on the use of American galls is a note by Dr. A. D. Hopkins on a black oak gall produced possibly by *Callirhytis* sp. This gall, because of its resemblance to wheat, is called "black oak wheat" and "wheat mass" (typographical error for mast[1]). Specimens of this gall were received from Westcott, Mo., with the information that they were very abundant and had been fed to cattle, hogs, sheep, turkeys and chickens all of which were fond of them and were getting fat on them. These galls were also received from Texarkana, Ark., where they were used to fatten hogs.

The following food analysis and report were made on these galls in the old Dendro-Chemical Laboratory, Bureau of Chemistry, U. S. Department of Agriculture, under the direction of the late Dr. W. H. Krug:

	Per Cent.
Moisture	12.24
Ether extract	3.37
Crude fiber (indigestible)	9.34
Protein	8.56
Ash	2.89
Carbohydrates (starch, etc.)	63.60
Relative food value = 93.43	
Nutritive ratio = 8.4	

The relative food value is high and the nutritive ratio is wide, showing that this material is especially adapted for fattening animals.

[1] Mast is used for nuts collectively, acorns, chestnuts, beechnuts, etc., especially when used as food for hogs and other animals.

CYNIPS GALLÆ-TINCTORIÆ Olivier

The gall of *Cynips gallæ-tinctoriæ* Olivier, known in commerce as the Aleppo gall, Turkey gall, Levant gall, gall-nut, gall of commerce and ink marble, is found in eastern Europe, that is, in Hungary, Turkey and Greece, and in western Asia, on *Quercus ægilops, Quercus infectoria, Quercus pedunculata* and possibly *Quercus humilis.* This gall as an article of commerce has had the longest history, having been used from the time of the ancient Greeks to the present; has been used for the greatest variety of purposes; and has been considered as the richest of all the galls known to the Western World.

Medicine.—The earliest use of this gall was in medicine in which capacity it was known to the Greeks and to the Romans. In Greece it was recorded as of medical value by Hippocrates in the fifth century B.C. and then by Theophrastus, third century B.C. Its use by the Romans was treated at some length by Pliny, who stated that twenty-three remedies were compounded of gall-nuts, and that among the diseases for which they were used were ulcerations of the mouth, affections of the gums and uvula, malformed nails, hang nails, etc., and that for the relief of toothache and burns the inner part of the gall should be chewed.

From these early days until very recent times authors of Materia Medica have included this gall-nut as a drug, designating it as "the most powerful of vegetable stringents." In modern times it has been used in Europe as a cure for fevers and was especially popular in France early in the eighteenth century. At that time Poupart in *Mem. Ac. Sci.,* 1702, made a report on it which proved it to be of doubtful efficacy. Nevertheless its use was continued and as late as 1849 Pereira, in London, listed it as useful for medical purposes, recommending it as a tonic in intermittents, an astringent in hemorrhages, a chemical antidote, a topical astringent and giving a list of six medicines concocted from it. At the present time gall

products are found in the British Pharmacopœia as astringent ointments and in the U. S. Pharmacopœia, 1916, ninth revision, the Aleppo gall still appears as the source of tannic acid and as the principal ingredient in the preparation *Unguentum gallæ*. It is now used only externally.

Ink.—In the manufacture of ink the Aleppo gall was long considered as a necessary ingredient, especially where a durable ink was required, as in court records. In some places the law required that records be made with ink compounded of gall-nuts.

This use of the gall is not of such ancient origin as the medical use, for Pliny, who quotes the older authorities on other matters, has made mention only of the ink compounded of lampblack, which was used also by the Chinese. Hoefer in his "Histoire de la Chimie" spoke of an ink used in the third and fourth centuries A.D., compounded of acid and metal solution but failed to say that this acid was obtained from gall-nuts. The ink made from gall apple was, however, well known to the monks of the ninth and tenth centuries, who used it in copying their manuscripts. An interesting reference to the ink made from gall-nuts occurs in Scheffel's "Ekkehard," a romance of the tenth century, in which the monk Ekkehard says ". . . all ink comes from gall apples and all gall apples from a wicked wasp's sting." Of course, this is of interest only if the knowledge of the origin of the gall apple were part of the experience of the tenth-century monk and not supplied from the knowledge of the nineteenth-century author. As the search to clear up this point would be long and arduous and the result of no real value it has not been made.

From the ninth century down to the present day, gall-nuts have been included in practically every good ink recipe for black writing and record inks. The Aleppo gall is considered as the best for ink-making, but other important ones are the Morea gall, the Smyrna gall, Marmora gall and Istrian gall, and other good quality galls

from France, Hungary, Italy, Senegal and Barbary. The Chinese and Japanese galls are also sometimes mentioned in recipes. The Japanese gall has been used in making school and other cheap inks.

The Massachusetts Record Commission in 1891 made a Report on Record Inks and Paper in which the superiority of gall-nut ink was attested. The ink made from gall-nuts was said to be permanent, if properly made, and to have the advantage that if the writing should fade it could be repeatedly restored by a solution of nut-gall or tannin. Any other coloring matter substituted in whole or in part for gall-nut and iron solution impairs the quality of the ink.

In 1912, Oyster in the "Spatula Ink Formulary" gives as the basis of the best black writing and record inks, gall-nuts. In the recipes for inks used by the United States Treasury, Bank of England, the German Chancellory, and the Danish Government the Aleppo gall is specified.

Lehnen also states that nut-gall extract forms an excellent material for the preparation of ink, especially where manufacturers can not keep large stocks of the nut-gall itself. According to the 1917 annual report of the *Oil, Paint and Drug Reporter,* large quantities of gall-nut extracts are imported into the United States. Of course, all of it may not be used for ink manufacture.

Tanning.—Among tanning materials this gall-nut is the richest of all in the tanning principle and has been used, for tanning purposes, in the preparation of hides and skins, but because of its expense and its value to the textile colorist it has not been extensively used. Experiments and analyses of these galls were undertaken, however, with a view to discovering the tanning principle in vegetable matter. Pliny mentioned the preparation of leather as being one of the uses of gall-nuts, Bosc recorded galls as being used in the tanning of hides and Davis in 1897 spoke of them as being the richest in tannin of all tanning materials, but made no further mention of

them in his descriptions of the processes of tanning. Other more recent writers on tanning materials have also listed oak galls,

Dyeing.—In the history of the art of dyeing, the Aleppo gall figures largely from the earliest mention of the art in literature up to the very present. According to Theophrastus it was used by the Greeks in dyeing wool and woolen goods and Pliny mentioned it as being used to stain the hair black and as the best adapted for the preparation of leather and the dyeing of skins. As the ancients could not conceive of a scholar's taking an active interest in the technical arts there is no record of how these galls were used, merely the statements that they were so used; and it was not until the end of the eighteenth century that any definite knowledge of these galls was sought.

It was at that time, when science invaded nearly every field of endeavor, that the chemists made an earnest effort to determine the chemical contents and action of gall-nuts, so as to place the arts of dyeing and tanning on a firmer and more scientific basis. Déyeux in 1793 was the first to separate the tannin in the gall-nuts and his experiments were followed up by Scheele, to whom is accredited the discovery of gallic acid. Berthollet and Fourcroy made more detailed analyses of the gall-nuts and gave more positive knowledge of the various properties and their chemical value.

Berthollet in "The Elements of the Art of Dyeing" gave perhaps the first scientific account of the art of dyeing with full explanations of methods and materials. According to his idea the great value of the Aleppo gall lay in its astringency and as it is most astringent before the insect escapes, the immature galls, or as they are called, the blue galls, are of the most value and are the ones used in dyeing black, while the white galls, or those from which the insect has escaped, are used in dyeing light linens. For the dyeing of black Berthollet considered that no

other astringent than an infusion of gall-nuts could be used in the dyeing bath, as too large a quantity of any other material would be necessary to obtain the same results.

Bancroft, however, in his "Philosophy of Permanent Color," 1813, opposed the idea that the astringency was the important property of the gall-nut and set forth the idea that it should be considered merely as a coloring matter. In defense of his theory he showed that tannin procured from different vegetable matter and combined with iron will not produce black, and gallic acid alone will not blacken solutions of iron, while either tannin or gallic acid from *galls* combined with iron forms a black dye or ink.

At the present time both these theories are known to be true for the Aleppo gall may be used as a fixing agent in dyeing or may be used as the basis of a good black dye. As a dye its use appears to be confined to the dyeing of leather and of sealskin fur.

In the dyeing of leathers and skins the Aleppo gall is used in small quantities with other dyeing materials to obtain the best and most permanent black. That the successful dyeing of leathers, however, is not dependent entirely upon a good dye is evident from the following statement on leather dyeing by Bennett, "Manufacture of Leather," 1909:

> The absorption of the dye by the fiber has been considered a case of chemical action, of physical action and even as a case of "solid solution," but it is highly probable that more than one type of action comes into play and that possibly all these theories may be true to a certain extent. It would, however, appear that with vegetable tannages the determining factor is the formation of color lakes with the tannin on the fiber. The tannins are of an acid nature and fix the basic dyes with great readiness, but the basic chrome-tanned leathers fix the basic dyes much less readily than the acid dyes, so it is clear that the nature of the tannage has considerable influence in the matter.

For the dressing and dyeing of sealskin furs, large quantities of the Aleppo galls were formerly shipped to

London, where all of our American sealskins were dressed and dyed for the market. Now, however, this industry has been established in the United States, and in 1914 gall-nuts worth $17,174 were imported from Bagdad for this purpose. As the method of dyeing sealskins is a very jealously guarded trade secret the American firm engaged in this enterprise has had to work out its own processes, and according to the Commerce Reports this has been successfully accomplished and one sale of American sealskins dressed and dyed in America has taken place, in St. Louis, in September, 1916.

Analysis.—A gall so widely known and of such great value has of course been analyzed many times and is the standard for the analysis of others. According to Trimble the most generally accepted analysis is that made by Guibort, which is as follows:

	Per Cent.
Tannic acid	65
Gallic acid	2
Ellagic acid, Luteo-gallic acid	2
Chlorophyll and volatile oil	0.7
Brown extractive matter	2.5
Gum	2.5
Starch	2
Woody fiber	10.5
Sugar, Albumen, Potassium sulphate, Potassium gallate, Gallate of lime, Oxalate of lime, Phosphate	1.3
Moisture	11.5
	100.00

CYNIPS INSANA Westwood

A gall somewhat resembling the Aleppo gall and often confused with it is that produced by *Cynips insana* Westwood. It is better known as the mad apple of Sodom, Dead Sea fruit, or Mecca or Bussorah gall, and is found in Palestine, Asia Minor, Albania and Italy on *Quercus*

infectoria, Quercus tauricola and *Quercus farnetto* (*conferta*). Its use is confined to the locality from which it takes one of its names, Bussorah or Basra.

This gall has furnished an interesting and somewhat mystifying theme to poets and has been often discussed by old writers who have tried to connect this so-called fruit with some of the unknown fruits mentioned in the Bible.

In Bussorah or Basra in Asia Minor, probably its native heath, this gall is used by the inhabitants in dyeing Turkey red, and it is more esteemed by them than the Aleppo gall.

Analysis.—The following analysis of this gall was made by Bley in 1853:

	Per Cent.
Tannic acid	26.00
Gallic acid	1.60
Fatty oil	0.60
Resin	3.40
Extractive and salts	2.00
Starch	8.40
Woody fiber	46.00
Moisture	12.00
	100.00

Cynips quercus-calycis Burgsdorf

The knoppern or acorn gall, also called the Piedmontese gall, and gall of Hungary, which is produced on *Quercus ægilops, Quercus pedunculata* and occasionally on *Quercus pubescens* and *Quercus sessiliflora,* occurs in Austria, Hungary, Slavonia, Bosnia, Serbia, Greece, Asia Minor and less abundantly in Germany, Holland, France and Italy. Among the Cynipid galls it ranks next in importance to the Aleppo gall and has been almost as frequently discussed.

In Austria it has been used chiefly by the tanners, but has also been substituted by dyers for the Aleppo gall. This gall, like the Aleppo, is at its best before maturity and should be collected from August to October.

At its height the Knoppern yields from 45 to 50 per cent. of tannin.

CYNIPS KOLLARI Hartig

The Devonshire gall is produced by *Cynips kollari* on *Quercus avellanæ-formis, Quercus fastigiata, Quercus humilis, Quercus ilex, Quercus lusitanica* and varieties, *Quercus mirbeckii, Quercus mongolica, Quercus pedunculata* and varieties, *Quercus pubescens, Quercus pseudoægilops, Quercus rubra, Quercus sessiliflora, Quercus suber* and *Quercus toza.* It occurs in middle and southern Europe, North Africa, Asia Minor, and was introduced into England from the continent early in the nineteenth century. It attracted much attention because of its rapid spread, but the interest in it seems to have been confined to England, as no important reference to it has been found elsewhere.

Attention was first drawn to this gall in England, when it became so abundant that the extermination of the oak forests seemed threatened by it. At that time, about 1858, many notices concerning it appeared in which fear was expressed that it would do irreparable injury to the oaks. But the damage done by it was of no great moment and when the gall was studied it was found to have some tanning and dyeing properties, and to be useful in making an excellent ink.

Many analyses were made of this gall in which varying amounts of tannin were accredited to it. The following was made in 1869 by Watson Smith:

	Per Cent.
Tannic acid	26.71
Gallic acid	Traces only
Woody fiber	47.88
Moisture	20.61
Coloring and loss	4.80
	100.00

RHODITES ROSÆ Linnæus

The Bedeguar of the rose, the gall produced by *Rhodites rosæ* Linnæus, occurs throughout Europe and in western

Asia on eighteen species of *Rosa,* and in North America on *Rosa canina* only. It was highly esteemed by the ancients, but has received very little mention in more modern times as being of any particular use to man.

This gall was mentioned by Pliny as being among the most successful applications for the restoration of hair. For this purpose it had to be powdered and mixed with honey. In Italy it has been used, when powdered and laid on the affected parts, to cure the bite of venomous creatures. This use by the Italians may have grown out of the story related by Pliny that the mother of one of the prætorian guard had a dream, after her son had been bitten by a mad dog, in which she was directed to procure the little round balls at the root of the wild rose and apply them to the affected part. Cuvier has recorded the Bedeguar of the rose as among the remedies successfully used against diarrhœa, dysentery, and cases of stones, scurvy and worms, and as late as 1868 the farmers near Harrogate were known to gather the mossy galls of the rose to make an infusion for diarrhœa in cows, for which they claimed to find it very successful.

Aulax sp. Rübsaamen

The gall of the sage or "Pomme de sauge" is produced by *Aulax* sp. Rübsaamen on *Salvia pomifera* and other species of *Salvia* in the Isle of Crete.

The earliest available record of the use of these galls is that by Belon in 1558 in which he described them as being large as galls, covered with hair and sweet and pleasant to the taste. They were collected at the beginning of May and sold by the people of Candie to neighboring villagers. Olivier stated that "they are esteemed in the Levant for their aromatic and acid flavor, especially when prepared with honey and sugar, and form a considerable article of commerce from Scio to Constantinople, where they are regularly exposed in the market."

Fockeu in 1897 mentions having found these galls in the East but states that to-day the old common name, Baisonge, is unknown and that the people of the country when questioned concerning them said that they had never noticed their existence and expressed doubt of their ever having been used for food, or in making confections.

This name "Baisonge" was not used by either Belon or Olivier for the gall of the sage, but has been used by Cuvier to designate a terebinthe gall from Syria.

AULAX GLECHOMÆ Linnæus

Another Cynipid gall which has been used as food is the gall of the ground ivy made by *Aulax glechomæ* on *Glechoma hederacea* L. It occurs in Lorraine and Sweden.

This gall was used in France as food and is said to have an agreeable taste and the sweet odor of the host-plant.

CHINESE OAK GALL

An unidentified oak gall, said to closely resemble the European gall, is one which was recorded in Pen T'Sau as Woo-shih-tsze.

The following translation of the note concerning it has been published by Pereira (*Pharm. Journ.*, Vol. 3, 1844, pp. 384–7):

> Woo-shih-tsze also comes from the West, and from India. The tree is said to be sixty or seventy cubits high and eight or nine cubits in circumference, and grows in sandy and stony places. It is compared . . . to the camphire tree. It flowers in the third moon; the flower is white, and rather red in the center. The bud formed is round like a ball; at first green—when ripe, yellowish. An insect eats into it and forms a hole in it. They say that the tree one year produces the Woo-shih-tsze, and another year produces something which resembles a chestnut.
>
> Another name is Whi-ztsip-tsze. It has various medicinal properties. It is used with some other ingredients for dyeing beards black.
>
> The taste of the Woo-pei-tsze is, according to them, a sour, saltish taste—of the Woo-shih-tsze, a bitter taste.

In the Materia Medica of China (Smith, 1871, p. 100) it is called "food for the foodless" and is recommended for medicinal use. It is said to differ little from those of the European market and to have been used formerly in making ink and in dyeing hair.

As this gall is described by the Chinese as coming from the "West" could it possibly be the Aleppo gall, the distribution of which is eastern Europe and western Asia?

Schlechtendalia chinensis (Bell)

Besides the Cynipid galls many others have been recorded as of use to man. Most of them are merely included in the native Materia Medica of China and India, but a few have had other uses.

The most important of these galls is the Chinese gall or Woo-pei-tsze, produced by *Schlechtendalia chinensis* on *Rhus semialata,* in northern India, China and Japan. It has been known and used by the Chinese for many centuries, perhaps even longer than the Aleppo gall has been known in the West. It rivals the Aleppo gall in importance and like the latter is still an important article of commerce.

The Chinese gall has been used in medicine, tanning, and dyeing, and is now imported into Germany and the United States for the manufacture of tannic acid, of which it yields about 70 per cent. As this gall has been fully treated in a paper by A. C. Baker, which has been submitted for publication it is unnecessary to give details here.

Chermes sp. (Baker)

The gall identified by Kirby and Spence as that of *Aphis pini* has been identified by Mr. A. C. Baker as *Chermes* sp., possibly *Chermes lapponicus* Chol, possibly some other. It occurs on spruce-fir in Lapland.

Linnæus states that this gall was used as food, and

Kirby and Spence suggested it as a possible dyeing material. Linnæus's description of it is as follows:

> The extremities of the branches of the spruce-fir bear small yellow cones. . . . When arrived at maturity they burst asunder and discharge an orange-colored powder which stains the clothes of those who approach the tree. I conceive these excrescences to be caused by some minute insects. The common people eat them raw as a dainty, like berries.

It was probably the reference to the orange-colored powder staining the clothes which led Kirby and Spence to suggest that this gall might be placed among dyeing materials.

PEMPHIGUS CORNICULARIS

The gall of *Pemphigus cornicularis,* called in India, Kakra-Singhee, in Syria, Baizonge, and in Europe, gall of the terebinth, occurs in southern Europe and Turkey, in Spain, Syria, China and India.

In India this gall is used in medicine by the natives who assign to it great astringent and tonic properties.

The Hindus have also used it, to a limited extent, in dyeing.

In Thrace and Macedonia Belon recorded it as being collected at the end of June, while still immature, and sold at high prices to the inhabitants of Bource, who used it in coloring fine silks. In Spain, Syria and China it was used as an ingredient in making scarlet dye.

ALDACAY GALLS

Galls called Aldacay or Caducay galls were recorded by Roxburgh in 1805 as occurring on the leaves of *Mimosa arabica* on the coast of Coromandel. Kirby and Spence in speaking of this gall called the host-plant *Terminalia citrina.*

These galls were said to have been among the most valued of the native dyeing materials and to have been sold in every market. The natives dyed their best and

most durable yellow with them, and they were also used by the chintz painters for their yellows. When mixed with ferruginous mud a strong black dye was obtained.

The astringent properties of these galls were evidently stronger than those of the fruit of the tree, as an ink made from the galls resisted the weather longer than that made from the fruit.

Roxburgh did not identify these galls, but suggested that they might be the "Faba bengalensis" of the old Materia Medica writers. The "Faba bengalensis" according to Bosc is the fruit of the *Myrobolan citrin* altered in its form by the puncture of an insect, but no dyeing properties are ascribed to it. As no further reference to these galls has been found they are still undetermined.

Summary

The important uses of galls have been in medicine, the manufacture of ink, tanning and dyeing, with a few references to their use as food, and one to their use as fuel.

In medicine the following galls have been used: *Andricus fœcundatrix* Hartig, *Cynips* sp. Cuvier on field cirsium, *Cynips gallæ-tinctoriæ* Olivier, *Cynips polycera* Giraud, *Cynips quercus-folii* Linnæus (*Cynips quercus-terminalis*) = *Biorhiza pallida* Olivier, *Cynips quercus-tozæ* Bosc, *Pemphigus cornicularis, Pemphigus pallidus, Rhodites rosæ* Linnæus, *Schlechtendalia chinensis* (Bell) and the undetermined ones: Chinese oak gall, Istrian gall, Marmora gall, galle corniculée, and Bazgendge (Fockeu) or Chersamel on *Tamarix.*

In the manufacture of ink the galls used are: *Cynips gallæ-tinctoriæ* Olivier, *Cynips kollari* Hartig, *Schlechtendalia chinensis* (Bell), the Aldacay or Caducay galls, the Istrian, Marmora, Morea and Smyrna galls and others from France, Italy, Hungary, Senegal and Barbary.

For tanning the following have been found useful: *Cynips gallæ-tinctoriæ* Olivier, *Cynips hungarica* Hartig, *Cynips insana* Westwood, *Cynips kollari* Hartig, *Cynips*

lignicola Hartig, *Cynips quercus-calycis* Burgsdorf and *Schlechtendalia chinensis* (Bell).

For use in dyeing have been recorded: *Cynips gallæ-tinctoriæ* Olivier (*Cynips tinctoria-nostra*) = *Cynips infectoria* Hartig, *Cynips insana* Westwood, *Cynips kollari* Hartig, *Cynips quercus-calycis* Burgsdorf, *Cynips quercus-petioli* Linnæus, *Pemphigus cornicularis, Schlechtendalia chinensis,* possibly *Chermes* sp. Baker, and the undetermined galls, Aldacay or Caducay galls, the gall-nut used by the Somali women for a tattooing dye, Baizonge Cuvier and Bazdyendge Pomet.

As food, only a few galls have been used: *Aulax* sp. Rübsaamen or Baisonge Fockeu, *Aulax glechomæ, Cynips* spp. Girault, *Disholcaspis weldi* (Beutenmüller), *Callirhytis* sp.? Hopkins, *Chermes* sp. Baker and *Schlechtendalia chinensis.* In the case of the last named the gall itself is not eaten but the powder found on the outside is used for seasoning soup.

As fuel for lamps the Greeks used *Cynips theophrastea* and an undetermined gall called by Pliny the black-gall-nut.

COMMON NAMES OF INSECT GALLS

In the following list of the common names of the insect galls which have been of any practical use, will be found a number of names for the gall of *Cynips gallæ-tinctoriæ* and several for that of *Schlechtendalia chinensis.* To avoid confusion I would suggest that for the former the name Aleppo gall be adopted, and for the latter the name Chinese gall, as it is under these names that they are designated in the commerce reports, in some of the trade journals and in the technical works on dyeing, tanning and ink manufacture.

Acorn gall	*Cynips quercus-calycis* Burgsdorf
Aleppo gall	*Cynips gallæ-tinctoriæ* Olivier
Baisonge Fockeu	*Aulax* sp. Rübsaamen
Baizonge Cuvier	*Pemphigus cornicularis*
Bara Mai	Hindu name of a gall on *Tamarix gallica*

Bazdyendge Pomet .....Turkish name for a gall on oak
Bazgendge Fockeu .....Turkish name for a gall on *Tamarix orientalis*
Bedequar of the rose .....*Rhodites rosæ* Linnæus
Black gall-nut Pliny .....Undeterminable
Black oak wheat .....*Callirhytis* sp.? Hopkins
Bussorah gall .....*Cynips insana* Westwood
Chersamel .....Egyptian name for Bazgendge (q.v.)
Chinese gall .....*Schlechtendalia chinensis* Bell
Chinese pear gall .....*Schlechtendalia chinensis* Bell
Chota Mai .....Hindu name for a gall on *Tamarix orientalis.*
Dead Sea fruit .....*Cynips insana* Westwood
Devonshire gall .....*Cynips kollari* Hartig
Fruits for the foodless .....A Chinese oak gall
Faba bengalensis .....A gall on *Terminalia chebula*
Gall of commerce .....*Cynips gallæ-tinctoriæ* Olivier
Gall of field cirsium .....*Cynips* sp. Cuvier
Gall of sage .....*Aulax* sp. Rübsaamen
Gall of *Mimosa arabica* Roxburgh . *?Faba bengalensis*
Gall-apple .....*Cynips gallæ-tinctoriæ* Olivier
Gall-nut Burton .....Undeterminable
Galle de France .....*Cynips kollari* Hartig
Galle en artichaut .....*Andricus fœcundatrix* Hartig
Galle corniculée Guibort .....Undeterminable
Gul-i-pista .....*Pemphigus pallidus*
Hungary gall .....*Cynips quercus-calycis* Burgsdorf
Ink marble .....*Cynips gallæ-tinctoriæ* Olivier
Istrian gall .....Undeterminable
Japanese gall .....*Schlechtendalia chinensis* Bell
Kakra Singhee .....*Pemphigus cornicularis*
Knoppern .....*Cynips quercus-calycis* Burgsdorf
Levant gall .....*Cynips gallæ-tinctoriæ* Olivier
Mad apple of Sodom .....*Cynips insana* Westwood
Marmora gall .....Undeterminable
Mecca gall .....*Cynips insana* Westwood
Nut-gall .....*Cynips gallæ-tinctoriæ* Olivier
Nut-gall .....*Schlechtendalia chinensis* Bell
Oak apple .....*Andricus quercus-californicus*
Oak-apple galls .....*Cynips* spp. Girault
Oriental gall .....*Cynips gallæ-tinctoriæ* Olivier
Piedmontese gall .....*Cynips quercus-calycis* Burgsdorf
Pomme de chene Guibort .....Undeterminable
Small crown gall of Aleppo .....*Cynips polycera* Giraud
Sumrat-úl-asl .....Arabic name for *Chota Mai* (q.v.)
Sumrat-úl-túrfa .....Arabic name for *Bara Mai* (q.v.)
Turkey gall .....*Cynips gallæ-tinctoriæ* Olivier
Wheat mass [Mast] .....*Callirhytis* sp.? Hopkins
Whip-ztsip-tze and Woo-shih-tsze ..A Chinese gall on oak
Wu-pei-tsze .....*Schlechtendalia chinensis* (Bell)

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